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Flora of Karabakh, plant cover and main directions of plant resources research

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The article provides information on the main directions of the study of flora, plant cover, and plant resources in the Karabakh region, based on the monitoring, analysis of herbarium and seed materials and analysis of published monographs, books, and scientific articles during the author's expeditions to the Karabakh region in pre-occupation years. According to these, priority areas of research to be conducted in the liberated territories are indicated. These works included the launch of a new edition of the multi-volume "Azerbaijan Flora" and at the same time the monographs "Flora of Karabakh", "Karabakh plant cover" and "Plant Resources of Karabakh", and developing the "Red Book of Karabakh". These studies are important in restoring the biodiversity of Karabakh. Protection and restoration works, which were planned to be carried out before the occupation, but due to the occupation factor was not completed are needed.

Keywords: *Karabakh, flora, plant growing, plant resources, Red Book, restoration, protection*

INTRODUCTION

As a result of the 44-day Patriotic War started on September 27, 2020, in the Republic of Azerbaijan, our lands in the territory of Karabakh and surrounding regions were liberated from occupation.

The Karabakh region is one of the most important regions not only in Azerbaijan, but also in the whole Caucasus, with its ancient history, unique material and cultural heritage, unique flora and fauna, rich underground and surface resources. It is no coincidence that the Azykh cave complex, one of the oldest human settlements in the world, is also located in Karabakh.

In these territories, which have been under enemy occupation for nearly thirty years, the flora, vegetation, and plant resources, an important component of biodiversity, as well as other resources of the region, especially valuable forests have been deliberately destroyed. Our valuable oak, beech, hornbeam and linden forests were cut down and looted in Kalbajar, Agdara, and Lachin districts. Armenians have increased their wood processing 4-5 times due to felled trees in Azerbaijan. In 1988, the forest fund in the liberated areas was 228,000 hectares, and in 2020 it was only 174,000 hectares, i.e. 54,000 hectares of forest fund was destroyed.

MATERIALS AND METHODS

Information on the flora, plant cover and plant resources of the territory was based on monitoring data conducted during numerous floristic expeditions to Karabakh under the authority of the author in the pre-occupation years, analysis of collected herbarium and seed materials and published data of obtained results (Asgarov, 2005, 2006, 2008, 2011, 2016, 2019; Asgarov et al., 2016). Furthermore, the materials of the Herbarium Foundation of the Institute of Botany of ANAS were studied in the Herbarium Fund of Botanical Institute of the Russian Academy of Sciences. The books and monographs published on this topic were used (Flora of Azerbaijan, 1950-1961; Prilipko, 1970; Hajiyev et al., 1990).

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Fig. 1. Physical and geographical regions of Karabakh

The botanical-geographical zoning of Karabakh is very important for the study of the biodiversity of the territory. According to the zoning scheme adopted in the multi-volume "Flora of Azerbaijan", botanists frequently consider 2 regions ("Center of the Lesser Caucasus" and "South of the Lesser Caucasus") as the whole borders of Karabakh. We see Karabakh in a broader sense, within physiographic districts: from the north-the Murovdagh range, territory of Tartar River joining the Kura River; From the east - the right bank of the Kura; From the south - the territory along the Araz; From the west, the state border of our Republic with Armenia. Comprehensive botanical-geographical zoning of Karabakh will be possible only after the completion of the study of the flora and plant growth of the territory, especially the investigation of endemism.

RESULTS AND DISCUSSION

The main directions of post-occupation research to be conducted in the Karabakh region are as follows.

I. Launch of a new edition of the multi-volume "Flora of Azerbaijan", design of "Karabakh flora". The implementation of this work is very important in a comprehensive study of the biodiversity of Karabakh. According to our current research, more than 2,500 higher plant species, found in the liberated territory of Karabakh account for 50% of the flora of Azerbaijan. We can now obtain information about the flora of Karabakh from the 8-volume "Flora of Azerbaijan" (Flora of Azerbaijan, 1950-1961) written in Russian 70 years ago, the unreleased "Trees and shrubs of Azerbaijan" (vol.I, 1961; vol.II, 1964; vol.III, 1970), as well as research on "The plant world of Azerbaijan" (Asgarov, 2016), "Cereals of Azerbaijan" (Musaev, 1991) and from researches conducted on some species.

II. Monograph of Karabakh vegetation and compilation of large-scale vegetation map. No special studies has been conducted on the vegetation of Karabakh. Fragmentary information can be obtained from the works of L. Prilipko" The plant world of Azerbaijan" (Prilipko, 1970), V. Hajiyev and others "Flora and plant growing of Lesser Caucasus" (Hajiyev et al.,1990). In Karabakh, the main vegetation types of Azerbaijan, especially forest, steppe, alpine and subalpine, rock vegetation are widely represented.

III. The plant resources of Karabakh also require detailed research. The State Program on Karabakh envisages the creation of "Atlas of natural resources of Karabakh". However, for this purpose must be conducted. biosystematic research first. At present, under our authority, research is being conducted on "Plant genetic resources of Karabakh." According to preliminary research, plant genetic resources in Karabakh belong to 14 gene pool groups (wild edible weeds; wild vegetable plants; fruits and berries; spices; cereals; grain legumes; legumes; fodder plants; medicinal herbs; essential medicinal plants; technical plants; vitamin plants; melliferous herbs; tinctorial plants) 664 genera, 1110 species. In many cases, the same species are represented in several gene pool groups. In the next years, the identification of their habitats, bioecological characteristics, reserves, protection and use opportunities will be studied.

More than 4,500 species of higher plants in the country are a source of natural raw materials with beneficial properties for our economy. Their study is very important from both the science and economic point of view.

As a result of the preliminary research conducted based on literary, herbarium-fund and internet resources, the classification of plant genetic resources distributed in the Karabakh region was carried out and a basic systematic syllabus was developed.

Table 1. Useful plant groups in the liberated areas

№	Useful plant groups	Families	Genera	Species
1.	Wild edible weeds	13	29	67
2.	Wild vegetable plants	39	97	124
3.	Fruits and berries	14	29	102
4.	Spices	24	59	91
5.	Grain legumes	1	9	20
6.	Cereals legumes	1	3	17
7.	Legumes	1	7	21
8.	Fodder plants	2	13	47
9.	Medicinal herbs	66	161	198
10.	Essential medicinal plants	15	37	66
11.	Technical plants	36	59	82
12.	Vitamin plants	9	51	107
13.	Melliferous herbs	31	82	138
14.	Tinctorial plants	23	28	30

Edible weeds are represented by 13 families, 29 genera and 67 species. The plants of great importance for human health as onion (*Allium* L.), nettle (*Urtica* L.), knotweed (*Polygonum* L.), sorrel (*Rumex* L.), ferula (*Prangos* Lindl.), caseweed (*Capsella* Medik.), amaranth (weed) (*Amaranthus* L.), sickleweed (*Falcaria* Fabr.), etc. belong to this group.

Wild vegetable plants are represented by 39 families, 97 genera and 124 species. Among the wild vegetable plants desert candle (*Eremurus* Bieb.), dropwort (*Asparagus* L.), nettle (*Urtica* L.), knotweed (*Polygonum* L.), goosefoot (*Chenopodium* L.), amaranth (weed) (*Amaranthus* L.), portucaceaea (*Portulaca* L.), purslane (*Bunias* L.), ground cherry (*Physalis* L.), and ferula (*Prangos* Lindl.) are valuable raw materials. Many of these are valuable vegetables, cereal, starchy plants with protein and sugar features, odorous, pleasant taste. Wild vegetable plants contain aqueous carbohydrates, proteins, fats, vitamins, alkaline mineral salts, organic acids, aromatic and specific flavors. In the human diet, their use regulates the activity of the nervous system, increases appetite, resistance to infectious diseases, and the ability to work increases when taken regularly. Most wild vegetables are resistant to cold (Gasimov et al., 2004).

14 families, 29 genera and 102 species of important food and nutrition plants belonging to the Karabakh region were determined. These plants include hazelnuts (*Corylus* L.), medlar (*Mespilus* L.), quince (*Cydonia* Mill.), fig (*Ficus* L.), apple (*Malus* Hill), pear (*Pyrus* L.), dog-rose (*Rosa* L.), sumac (*Rhus* L.), blackberries (*Rubus* L.) etc. The composition of these plants is rich in vitamins, microelements, pectin, proteins, carotenoids, fiber and other biologically active substances important for the human body (Gasimov et al., 2004).

Abstracts of 24 families, 59 genera and 91 species of spice plants belonging to the research territory were made. 14 species of them are trees and shrubs. These include onion (*Allium* L.), sorrel (*Rumex* L.), barberry (*Berberes* L.), sumac (*Rhus* L.), fennel (*Foeniculum* Hill), mint (*Mentha* L.), thyme (*Thymus* L.) etc. plants. The composition of these plants contains vitamins, microelements, proteins, fats, carbohydrates, sugars, organic acids, etc. important for the human body. Aromatic compounds in spice raw materials consist of very complex components. Aromatic substances accumulate in the leaves, roots and rootstock, stems and peel of the plant. In rare cases, it accumulates in flowers and seeds. The bitter substances in spices are very important. Thus, they improve digestion by increasing gastric juice.

20 most promising species of 9 genera belonging to *Gramineae* family were studied. These species are annual and perennial grasses. These are of food and forage significance. The most widespread species of wheat (*Triticum* L.), rye (*Hordeum* L.), millet (*Panicum* L.), barley (*Hordeum* L.), goat grass (*Aegilops* L.), palmgrass (*Setaria* Beauv.) also cover the Aran Karabakh region.

Cereal legumes include 17 promising species belonging to 3 genera of the legume family. These are annual and perennial herbs. They are high-protein crops and are used as food and forage. Lentil (*Lens* Mill.) and wild pea (*Pisum* L.), as well as high-forage varieties of vetch (*Vicia* L.) are more common in Aran Karabakh territories.

The group of leguminous forage plants includes 30 species belonging to 9 genera of the legume family. They are annual and perennial herbs. These are the most important forage plants (*Astragalus* L., *Lotus* L., *Trigonella* L., *Dorycnium* Mill., *Lagonychium* Bieb.), medicinal herbs (*Glycyrrhiza glabra* L., *Melilotus officinalis* (L.) Pall.) and mostly spread in the mountainous part of Karabakh.

Fodder grasses include (1 genus, 2 species) important promising representatives of the *Leg-*

umes and *Gramieae* families (12 genera, 45 species). They are most widespread in the mountainous part of Karabakh. The most common species are the genus wheat-grass (*Elytrigia* Desf.), fescue (*Festuca* L.), rye-grass (*Lolium* L.), meadow-grass (*Poa* L.) and timothy (*Phleum* L.).

The most promising medicinal plants are represented by 66 families, 161 genera and 198 species. According to N. Mehdiyeva (Mehdiyeva, 2021), who studied medicinal plants in Azerbaijan, 606 species of medicinal plants belonging to 110 families and 397 genera (11 of them are lichens) are widespread in Karabakh and 66 species of them are used as medicine in official medicine.

The most widespread medicinal plants in the Karabakh region are medicinal dandelion (*Taraxacum officinale* Wigg.), common butter-bur (*Tussilago farfara* L.), medicinal fern (*Nasturtium officinale* R. Br.), field horse-tail (*Equiesetum arvense* L.), sclerophyllus (*Heracleum pastinacifolium* C.Koch), marshmallow (*Althaea* L.), nipplewort (*Chelidonium* L.), fumitory (*Fumaria* L.), and others. Many of these plants play an important role in the development of new medicines.

There are 66 species of oilseeds and essential oil plants of 15 families and 37 genera in the Karabakh region. This group includes water mint (*Mentha aquatica* L.), common caraway (*Carum carvi* L.), common fennel (*Foeniculum vulgare* Mill.), odorous celery (*Apium graveolens* L.), common wormwood (*Artemisia vulgaris* L.), medicinal balm (*Melilotus officinalis* L.), catnip (*Nepeta* L.), elecampane tall (*Inula helenium* L.) etc.

In this region, technical plants are represented by 36 families and 82 species of 59 genera. These include Georgian oak (*Quercus iberica* Stev), quinquelocular hawthorn (*Crataegus pentagyna* Waldst.et Kit. (incl. *C.atrofusca* Stev.ex Fisch.et Mey.), sumac (*Rhus* L.), broadleaved linden (*Tilia platyphyllos* Scop. (*T.prilipkoana* Grossh. et J.Wagner, *T. begoniifolia* Stev)), common wayfarling-tree (*Viburna opulus* L.), Caucasus groundsel (*Senecio caucasicus* (Bieb.) DC. (*Dolichorrhiza caucasica* (Bieb.) Galushko)), oblong juniper (*Juniperus oblonga* M.Bieb.), flattened meadow-grass (*Poa compressa* L.), common carline (*Carlina vulgaris* L.).

According to the group of vitamin-containing plants, there are 9 families, 51 genera, 107 species of trees, shrubs and grasses. These plants are rich in vitamins A, D, E, C and B. The most common fruit plants are cotoneaster (*Cotoneaster* Medic.), pear (*Pyrus* L.), service tree (*Sorbus* L.), medlar (*Mespilus* L.), hawthorn (*Crataegus* L.), blackberry (*Rubus* L.), strawberry (*Fragaria* L.), dogrose (*Rosa* L.), plum (*Prunus* Mill.), cour cherry (*Cerasus* Juss.), from legume plants -clover (*Trifolium* L.), pea (*Lathyrus* L.), vetch (*Vicia* L.), from cereal plants - barley (*Hordeum* L.), fescue (*Festuca* L.), meadow-grass (*Poa* L.) and others. These plants are mainly distributed in the mountainous part of Karabakh.

İt has been specified that in the Karabakh region 138 species of melliferous plants in 31 families and 82 genera were distributed. 29 species of these are distributed in the mountainous part of Karabakh, 20 species in Aran Karabakh. Other species are found in both territories of Karabakh. Primary melliferous plants include Bieberstein's rock currant (*Ribes biebersteinii* Berl. ex DC), western apple (*Malus orientalis* Uglitzk.), scabrous everlasting pea (*Lathyrus hirsitus* L.), common germander (*Teucrium chamaedrys* L.), hawthorn (*Crataegus* L.).

The majority of crops, which make up 15-17% of the wild plants found in the flora of Azerbaijan, are melliferous plants. Shrubs and broad-leaved forests are of great importance for beekeeping.

The distribution of 30 species of tinctorial plants in 23 families and 28 genera in the Karabakh region has been specified. Common privet (*Ligustrum vulgare* L.), common marjoram (*Origanum vulgare* L.), hazelnut (*Juglans* L.), Saint-Johns wort (*Hypericum perforatum* L.), common barberry (*Berberes vulgaris* L. (*B. orientalis* C. K. Schneid.), etc. widely used for the paint industry.

Tinctorial plants are plants used to dye wool, silk and cotton products by preparing a dye extracted from parts of roots, stems, branches, rootstock, leaves, flowers, fruits or seeds.

According to M.Gasimov (Gasimov, 1980), tinctorial plants found in our republic assosiated in 110 families and 358 genera and are 36% of our total flora.

IV. Study of rare and endangered plant species of Karabakh, making of "Red" and "Green" books. The main factor that makes these studies relevant is the fact that the flora of this territory has been under Armenian occupation for almost 30 years.

Most of the 400 rare and endangered plants included in the 1st (1989) and 2nd (2013) editions of the Red Book of Azerbaijan are found in Karabakh: orchis (*Ophrys* L.), common yew (*Taxus* L.), germander (*Teucrium* L.), some species of Sternbergia (*Sternbergia* Waldst. et Kit.), Yurineya (*Jurinea* Cass.) etc. known under the names Shusha milk vetch (*Astragalus schuschensis* Grossh.), Garabagh tulip (*Tulipa karabachensis* Grossh. (*T. confuse* Gabr.)), Shusha sainfoin (*Onobrychis schuschajensis* Agaeva), Khari bulbul (*Ophrys caucasica* Woronow ex Grossh.). During the past period, no practical measures were taken to save our natural monuments, rare and endangered flora and fauna. During the pre-occupation period, in these territories, we recorded 264 rare higher plant species belonging to 65 families and 171 genera. There were 21 species of endemics belonging to 12 families, 17 genera, 34 families, 84 genera, 119 subendemics, 51 families, 99 genera, 169 species of rare and endangered plants, about 54 species of rare trees and shrubs (Asgarov et al., 2017).

Forest Restoration based on world experience is one of the most important issues. The study of specially protected natural areas (reserves, reservations, etc.), their expansion and the creation of new ones require extensive research. This work is also envisaged in the State Program on Karabakh.

The liberated lands also have state nature reserves and preserves. Two state nature reserves with a total area of 43,000 hectares, four state nature preserves, 152 natural monuments - ancient trees were looted.

One of them - Basitchay State Nature Reserve in Zangilan district was established in 1974 on the initiative of great leader Heydar Aliyev. It is considered a unique forest in Europe, and there were rare plane trees. This reserve covered an area of 107 hectares along the river for 15 km (width 150-200 m) during the pre-occupation period, and now there are only 42 hectares left.

Specially Protected Natural Areas in Gubadli, Shusha and Lachin districts have also been almost destroyed.

In the forests along the Tartar River, in a territory of 50 km were recorded walnut trees. Here, at an altitude of 700 m above sea level, new natural areas of ordinary chestnut trees were found.

Holly, yew, beech and hornbean forests, which are considered to be relict plants of the third period, were also found in Karabakh. These unique relict forest areas were the only ones in the Lesser Caucasus (within Azerbaijan).

We propose to clarify and protect these areas, found by our research scientists during the pre- occupation period, as a preserve.

Organization of the work on ethnobotanical research of Karabakh, organization of documentaries, radio and television programs on the nature of Karabakh, preparation of brochures and booklets, implementation of large-scale scientific and mass events are considered to be very important.

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Qarabağın florası, bitki örtüyü və bitki ehtiyatlarının tədqiqinin əsas istiqamətləri

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Məqalədə müəllifin Qarabağ bölgəsinə, əsasən işğaldan əvvəl təşkil etdiyi ekspedisiyalar zamanı apardığı monitorinqlər, topladığı herbari və toxum materiallarının təhlili və nəşr olunmuş monoqrafiya, kitab və elmi məqalələrin təhlili əsasında regionun florası, bitki örtüyü və bitki ehtiyatlarının tədqiqinin əsas istiqamətləri haqqında məlumat verilir. Bu istiqamətlər üzrə işğaldan azad edilmiş ərazilərdə aparılacaq tədqiqat işlərinin prioritet sahələri göstərilir. Bu işlərdən "Azərbaycan florası" çoxcildliyinin yeni nəşrinə başlanılması və bununla paralel "Qarabağın florası", "Qarabağın bitki örtüyü" və "Qarabağın bitki ehtiyatları" monoqrafiyalarının yazılması, "Qarabağın Qırmızı kitabı"nın işlənib hazırlanması qeyd edilir. Bu tədqiqatların bütövlükdə Qarabağın biomüxtəlifliyinin bərpa olunmasındakı mühüm əhəmiyyəti əsaslandırılır. İşgaldan əvvəl həyata keçirilməsi nəzərdə tutulan, lakin işğal faktoru ilə əlaqədar yarımçıq qalmış mühafizə və bərpa işlərinin təcili olaraq həyata keçirilməsinin zəruriliyi qeyd olunur.

Açar sözlər: *Qarabağ, flora, bitkilik, bitki ehtiyatları, Qırmızı kitab, bərpa, mühafizə*

Основные направления исследования флоры, растительности и растительных ресурсов Карабаха

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В статье приводятся данные об основных направлениях исследования по изучению флоры, растительности и растительных ресурсов Карабахского региона. Эти данные были получены автором в результате проведенных им мониторингов, анализов гербарных материалов и семян, собранных во время флористических экспедиций по Карабаху. Были использованы также важнейшие публикации по теме. Одновременно приводятся приоритетные работы, которые необходимо реализовать на освобожденных от оккупации землях. Основные из них следующие: начало работы по переизданию многотомного издания (многотомника) «Флора Азербайджана» на азербайджанском языке; составление монографических работ: «Флора Карабаха», «Растительный покров Карабаха», «Растительные ресурсы Карабаха», «Красная книга Карабаха». Далее в статье обосновывается большая роль этих работ в изучении биоразнообразия Карабаха. В статье отмечается необходимость выполнения ряда незаконченных работ по охране и восстановлению растительного покрова Карабаха в связи с оккупацией этих территорий Вооруженными силами Армении.

Ключевые слова: *Карабах, флора, растительность, растительные ресурсы, Красная книга, охрана*